C - 4.3

Procudure Deveolpment For the Trajectory Reconstruction of a Probe Descening in a Planetary Atmosphere: Application to Galileo and HASI Balloon Tests

V. Gaborit

Laboratoire d'Etudes Spatiales et d'Instrumentation en Astrophysique (LESIA), Observatoire de Paris-Meudon, 5 place Jules Janssen, 92195, Meudon, France

email: vicent.gaborit@obspm.fr

The Huygens probe will enter Titan's atmosphere on January 14th 2005. The probe trajectory reconstruction will be needed to analyse, interpret and correlate all the data taken from each instruments on board Huygens. The Huygens Atmospheric Structure Instrument (HASI) which includes accelerometers, pressure and temperature sensors, will provide essential data to perform an accurate trajectory reconstruction. On the basis of these data, recovered from the HASI sensors, a modular software has been developed at LESIA (Laboratory for Space Studies and Astrophysical Instrumentation) at the observatory of Paris-Meudon. The goals of this software are to perform an accurate trajectory reconstruction during both the entry phase and the descent phase and to deliver the density, pressure and temperature atmospheric profiles throughout the descent. In addition, the choice of a modular configuration facilitates easy implementation for other planetary missions.

Here are presented the algorithms and the method used to reconstruct the probe trajectory during both the entry and the descent phase. This presentation consists in the description of the model used for the probe during the entry and descent configuration, the model used for the planet (gravity field and atmospheric properties) and finally, the set of equations and the integrator scheme used to perform the trajectory reconstruction. This software was tested with the Galileo Atmospheric Structure Instrument data, available in the NASA PDS (Planetary Data System) archives. In addition, three balloon tests were launched in summer 2001, 2002, and 2003 respectively to simulate in the Earth atmosphere the Huygens probe descent. A 1:1 scaled mock-up of the Huygens probe, equipped with HASI spare sensors, was released at 32 km altitude and decelerated by a parachute. Data recovered from the successful 2002 balloon campaign were used to test the developed software and the analysis of the data from the successful 2003 balloon campaign is in progress. The results of these different software tests are presented and discussed.